UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,473	03/15/2005	Sanjeev Nagulcswaran	3127-14	1540

23117 7590 11/14/2007

NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

MAIL DATE	DELIVERY MODE
11/14/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/510,473	NAGULESWARAN ET AL.	
	Examiner	Art Unit	
	Un C. Cho	2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 September 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 – 12 and 14 – 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chennakeshu (US 6,137,843) in view of Lee (US 6,581,182 B1).

Regarding claim 1, Chennakeshu discloses (a) receiving a signal transmission including a plurality of user signals on a TDMA channel (Chennakeshu: Col. 3, line 43 through Col. 4, line 4 and Col. 14, lines 4 – 6); (b) detecting one or more user signals and determining transmission channel estimates for each said user signal (Chennakeshu: col. 4, lines 5 – 23); (c) deriving a soft signal for a first user by subtracting, if available weighted representations of other user signals from the detected user signal of said first user (Chennakeshu: Col. 5, lines 42 – 65) and returning to (a), (b) or (c) with the refined probabilities forming part of the weighted representations to be subtracted from detected user signals of other users (Chennakeshu: col. 4, line 56 through Col. 5, line 65).

However, Chennakeshu as applied above does not specifically disclose (d) calculating a posteriori probabilities for each symbol comprising the soft signal; (e) refining said probabilities utilizing the transmission channel estimate

for the first user in an iterative decoding algorithm, wherein a probability is either partially or fully decoded depending on application of decoder convergence criteria. In an analogous art, Lee remedies the deficiencies of Chennakeshu by disclosing calculating a soft decision (a posteriori) reliability values for the information bits; refining said reliability values by iteration such as "full iteration" or partial iteration through the use of a soft-output Viterbi algorithm (SOVA) and this process may be repeated until the results are satisfactory (Lee: Col. 2, line 50 through Col. 4, line 17). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the technique of Lee to the system of Chennakeshu in order to provide an efficient way of iterative decoding in which reliability values for detected data are updated with each iteration of decoding for a more accurate and reliable results by reducing complexity of circuits in concatenated coded systems.

Regarding claim 2, Lee as applied above discloses producing a hard signal for the first user and discontinuing further steps depending on the application of receiver convergence criteria to the decoded probabilities (Lee: Col. 4, line 63 through Col. 5, line 19 and Col. 7, lines 6 – 67).

Regarding claim 3, Chennakeshu discloses wherein during the first iteration of the iterative receiver process, the decoder convergence criteria includes comparing the interference on the detected user signal for the first user with an interference threshold determined by estimating the noise equivalence of interference on the detected user signal due to other user with the probabilities

being fully decoded if the interference is below the interference threshold or partially decoded if the interference is above the interference threshold (Chennakeshu: Col. 7, line 57 through Col. 8, line 18 and Col. 4, line 56 through Col. 5, line 65).

Regarding claim 4, Lee as applied above discloses wherein the decoder convergence criteria includes adaptively adjusting a threshold of a stopping criteria, a probability being fully decoded when application of the stopping criteria to a probability results in a value less than the threshold and partially decoded when the application of the stopping criteria results in a value greater than the threshold (Lee: Col. 7, lines 6 – 67 wherein the decoder convergence criteria is adaptively adjusted).

Regarding claim 5, Lee discloses wherein the stopping criteria utilize the refined probabilities from a previous iteration of the iterative decoding algorithm (Lee: Col. 4, lines 6 – 67).

Regarding claim 6, Lee as applied above discloses wherein the stopping criteria comprises a sign change ratio stopping criteria (hard decision; Lee: Col. 4, line 63 through Col. 5, line 2)

Regarding claim 7, Lee as applied above discloses wherein the decoder convergence criteria utilizes a stored value of an optimal number of iterations of the iterative decoding algorithm for any particular iteration of the iterative receiver process (Lee: Col. 7, lines 6 – 39).

Regarding claim 8, Lee as applied above discloses wherein the stored values are calculated from at least one of investigation of the convergence behavior of the iterative decoding algorithm and the iterative receiver process (Lee: Col. 7, lines 6 – 67).

Regarding claim 9, Lee as applied above discloses wherein an investigation includes analyzing an exchange of mutual information between the output of (c) and (e) during an offline simulation of the iterative receiver process (Lee: Col. 7, lines 6 – 67).

Regarding claim 10, Chennakeshu in view of Lee as applied above discloses wherein steps (c) (d) and (e) are carried out in parallel for each of the plurality of users detected in step (b) (Chennakeshu: Col. 5, lines 42 – 65 and Col. 2, lines 55 – 65 and Lee: Col. 2, line 50 through Col. 4, line 17).

Regarding claim 11, Lee as applied above discloses wherein the refined probabilities for each user are combined with updated channel estimates to form the weighted representations of user signals used in a subsequent iteration of the iterative receiver process (Lee: Col. 3, line 55 through Col. 4, line 17).

Regarding claim 12, Chennakeshu discloses wherein the updated channel estimates for each user signal comprise an estimate of characteristics selected from the group of timing, interference, frequency, amplitude, phase and interference (Chennakeshu: Col. 2, lines 49 – 65).

Regarding claim 14, the claim is interpreted and rejected for the same reason as set forth in claim 1.

Regarding claim 15, the claim is interpreted and rejected for the same reason as set forth in claim 2.

Regarding claim 16, the claim is interpreted and rejected for the same reason as set forth in claim 3.

Regarding claim 17, the claim is interpreted and rejected for the same reason as set forth in claim 4.

Regarding claim 18, the claim is interpreted and rejected for the same reason as set forth in claim 5.

Regarding claim 19, the claim is interpreted and rejected for the same reason as set forth in claim 6.

Regarding claim 20, the claim is interpreted and rejected for the same reason as set forth in claim 7.

Regarding claim 21, the claim is interpreted and rejected for the same reason as set forth in claim 8.

Regarding claim 22, the claim is interpreted and rejected for the same reason as set forth in claim 9.

Regarding claim 23, Lee as applied above discloses a plurality of calculating means and digital signal processor for the parallel refining and decoding of a posteriori probabilities for each of the plurality of users detected by the detector (Lee: Col. 2, line 50 through Col. 4, line 17).

Regarding claim 24, Chennakeshu discloses a channel estimator for providing updated channel estimates for each user and combining the updated

channel estimates with the refined probabilities to form the weighted representations of user signals used in a subsequent iteration of the iterative receiver process (Chennakeshu: Col. 4, line 56 through Col. 5, line 65 and Col. 7, line 57 through Col. 8, line 18).

Regarding claim 25, the claim is interpreted and rejected for the same reason as set forth in claim 12.

3. Claims 13 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chennakeshu in view of Lee as applied above in claim 1, and further in view of Sequeira (US 2002/0021747 A1).

Regarding claim 13, Chennakeshu in view of Lee as applied above does not specifically disclose wherein the iterative decoding algorithm is a turbo decoding algorithm. In an analogous art, Sequeira discloses using turbo code (Sequeira: Page 3, Paragraph 0047, lines 1 – 9). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the technique of Sequeira to the modified system of Chennakeshu in view of Lee in order to improve the performance of a receiver utilizing either interference cancellation or partial interference cancellation.

Regarding claim 26, the claim is interpreted and rejected for the same reason as set forth in claim 13.

Response to Arguments

4. Applicant's arguments with respect to claims 1 – 26 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Un C. Cho whose telephone number is (571) 272-7919. The examiner can normally be reached on M ~ F 8:00AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on (571) 272-7495. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Un C Cho
Examiner
Art Unit 2617

11/13/07 uc

GEORGE ENG
SUPERVISORY PATENT EXAMINER